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Allelopathic Activities of Some Weeds in the Asteraceae Family

¹O.J. Ilori, ²O.O. Otusanya, ²A.A. Adelusi and ¹R.O. Sanni

¹Adeyemi College of Education Ondo, Nigeria

²Obafemi Awolowo University Ile-Ife, Nigeria

Abstract: *Helianthus annuus*, *Chromolaena odorata* and *Tithonia diversifolia* are weeds in the family Asteraceae. The present study was aimed to investigate the phytotoxic activities of these weeds on the seed germination and seedling growth of *Vigna unguiculata*. The seeds of the test crop were sown in petri dishes lined with filter paper moistened with the different aqueous extract prepared from the weeds while control received distilled water. The results showed that the germination and seedling growth of *Vigna unguiculata* were inhibited by the application of fresh leaf extract of *Chromolaena odorata*. All the different extracts inhibited the root length of the test plant. It was suggested that these weeds be controlled in the field where they grow in association with cultivated crops.

Key words: *Helianthus annuus*, *Chromolaena odorata*, *Tithonia diversifolia*, *Vigna unguiculata*, aqueous extract, phytotoxic

INTRODUCTION

Chromolaena odorata, *Helianthus annuus* and *Tithonia diversifolia* are members of the family Asteraceae. These plants are aggressive weeds that have the ability to compete with agricultural crops. According to Eze and Gill (1992) the weeds contain a large amount of allelochemicals especially in leaves which inhibit growth of many plants.

Detrimental effects of allelochemicals on plants germination and growth have been reported (Bogatek *et al.*, 2006). Aqueous extract of the root of *Helianthus tuberosus* L. *Lactuca sativa* and *Cirsium japonica* all in the family of Asteraceae inhibit the growth of *Amaranthus retroflexus*, *Cucumis sativa* and *Hordeum vulgare* (Stachon and Zindel, 1980). Leaf area can be reduced as a result of application of some synthetic allelochemicals (Patterson, 1981). Reduced leaf area could result in lower photosynthetic capacity for a plant and ultimately limit growth (Frederic and Camberato, 1995). Allelochemicals from *Wedelia troblabata* reduced germination, plants height, fresh and dry weights root and shoot per plants of rice (Chengrong *et al.*, 2005). Aqueous leachate of (*Chenopodium album*) plant parts (root, whole plant and leaf) inhibit the germination, plant height, growth and biomass of *Cassia occidentalis* (Daizy *et al.*, 2006). Ratwat *et al.* (2002) stated that aqueous extract of root of *Helianthus annuus* delayed and inhibited the germination and seedling growth of linseed (*Linum usitatissimum* L.) and mustard (*Brassica juncea*). Aqueous extracts from the leaves of *Helianthus tuberosus* L.

Xanthium occidentale, *Lactuca sativa* and *Cirsium japonica* all in the Asteraceae family inhibited the root growth of lucerne (Chon *et al.*, 2003).

These weeds are capable of posing a threat of phytotoxicity to agricultural crops. Considering the fact that these weeds grows in association with cultivated crops therefore the objective of this study was to determine the effect of aqueous extract of *Chromolaena odorata*, *Helianthus annuus* and *Tithonia diversifolia* on *Vigna unguiculata*.

MATERIALS AND METHODS

This experiment was carried out at the Department of Biology, Adeyemi college of Education Ondo, Ondo State Nigeria during September - December 2009. To prepare the extract, 110 g of the leaf of *Chromolaena odorata*, *Helianthus annuus* and *Tithonia diversifolia* were collected and cut into small chips of about 4 cm length and later grated with mechanical grater. The ground plant parts were soaked in 1 L of water for about 24 h. The filtration obtained served as treatment for the seedlings in the aqueous extract regime. Experimental petri dishes were allocated randomly to the control (no any application than water) and fresh leaf aqueous extract treatment regime.

Seeds of *Vigna unguiculata* were sown in petri dishes containing filter paper and 10 mL of the different extract, control seedling were treated with 10 mL of distilled water. Seedling in petri dishes were then allocated to the control and aqueous extract regimes. The petri dishes were laid in a completely randomized design. Plants

were harvested and reading taken from the second day to 7 days (1 week). Root length, shoot height were determined. For the shoot height the distance between the base of a shoot and upper part of the terminal bud of the seedling were measured using a meter rule. The root system was measured as a distance between the base of plant and root tip. Measurements were carried out on the entire seedlings that germinated in both the treatment regime and control regime and mean value were calculated.

Experiments were conducted in three replicates and the data obtained were subjected to Analysis of Variance (ANOVA) at $p < 0.05$.

RESULTS

Table 1 shows the effect of the application of fresh leaf aqueous extracts on the germination of seeds of *Vigna unguiculata*. The germination of seeds treated with the extract of *Chromolaena odorata* were inhibited while the seeds germination were enhanced by the application of the extract prepared from *Tithonia diversifolia* and *Helianthus annuus*. The shoot height and root length of the seedlings in the aqueous extract of *Chromolaena odorata* is shown in Table 2. These growth parameters were reduced by the application of the extract. The shoot length of seedlings in the aqueous extract of *Tithonia diversifolia* was higher than that of the control. The root lengths of the treated plants were reduced by the application of the extracts.

DISCUSSION

The genus *Vigna* contains several species that are of considerable economic importance. In many developing countries, cowpea (*Vigna unguiculata* L. Walp.) are key dietary staples for many millions of people. Many of these *Vigna* species are also valued as forage, cover and green manure crops in many parts of the world.

In this study, the germination of *Vigna unguiculata* seeds treated with fresh leaf aqueous extract of *chromolaena odorata* was found to be lower than the germination of seeds in the control regime. This was consistent with the finding of Inderjit and Darkshimi (1994) who found that the water extracts from the roots of *Pichea lanceolata* in the family Asteraceae inhibited the germination of tomato and mustard. A similar study of Mulatu *et al.* (2006) reported that aqueous extract of *Parthenium hysterophorus* leaves and flower inhibited seed germination of lettuce. However the result from this study was inconsistent with the study of Bruckner *et al.* (2003), who observed no significant inhibition of the germination of *Amaranthus hypochondriacus* L. when treated with water extract of *Ambrosia artemissi* a species of Asteraceae. Also the result was contrary with the study of Javed and Asghari (2008), who stated that the leaf extract of *Helianthus annuus* inhibited the rate of germination of wheat seedlings. Evident from the result obtained from this study was the fact that root length of the seedlings treated with the aqueous extracts was lower than that of the control. This finding agreed with that of Chon *et al.* (2003), who stated that the aqueous extracts from the leaves of *Helianthus tuberosus* L. *Xanthium occidentale*, *Urtuca sativa* and *Cirsium japonica* all in the Asteraceae family inhibited the root growth of Lucerne. The result was further supported by the study of Ilori *et al.* (2007) who stated that the radical growth of *Oryza sativa* was inhibited by aqueous extract of *Tithonia diversifolia*.

CONCLUSION

The fresh tissue extract prepared from *Chromolaena odorata* *Helianthus annuus* and *Tithonia diversifolia* had an inhibitory effect on the germination and seedling growth of *Vigna unguiculata*. Therefore, considering the economic importance of cowpea, it is pertinent to control these weeds where they grow in association

Table 1: Effect of aqueous extract of *Chromolaena odorata*, *Helianthus annuus*, *Tithonia diversifolia* extracts on the germination of *Vigna unguiculata*

Control	<i>Chromolaena</i> extract	<i>Helianthus</i> extract	<i>Tithonia</i> extract
8	5	5	7
5	3	6	6
4	3	8	8
Total			
17 (56.7%)	11 (36.7%)	19 (63.3%)	21 (70%)

Table 2: Effect of aqueous extract of *Chromolaena odorata*, *Helianthus annuus* and *Tithonia diversifolia* on seedling height and root length of *Vigna unguiculata*

Parameter	Control	Aqueous extract of <i>Chromolaena odorata</i>	Aqueous extract of <i>Helianthus annuus</i>	Aqueous extract of <i>Tithonia diversifolia</i>	F-value	Sig.
Shoot height (cm)	6.64	3.70	6.70	7.90	2.369	0.109
Root length (cm)	6.67	3.20	2.70	3.20	3.735	0.033

with cultivated crops. This would go along way in increasing the yield of cowpea.

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